

DAVIS-BESSE

DENNIS ADAMS

Background

- Initial Criticality-August 12, 1977
- 2272 MW thermal output
- Operating Pressure-2155 psig
- Design Pressure- 2500 psig
- Accumulated Full Power Years-15.88
- Status: Shutdown for 13th Refueling Outage

Geometry

- RPV Head has 69 Nozzles, 61 CRDM, 7 spares, 1 vent
- Nozzle Material: Alloy 600
- Head Attachment: Alloy 182 J groove weld
- Head Material: Low alloy steel with internal stainless steel cladding

Probable Cause

- CRDM nozzle leakage with throughwall cracking
- Damage Mechanism: Primary Water and Stress Corrosion Cracking (PWSCC)

Contributing Causes

- Design-difficult to clean and inspect
- Deferral of Mod to install access ports to facilitate cleaning and inspection

Causal Factors

- Visual Inspection Inhibited
- Early BA Accumulation-CRDM flange leakage
- CRDM nozzle not element of Boric Acid Corrosion Control Program
- BA accumulation not recognized as a safety significant issue
- Lack of collective significance-BA deposition and accumulation on other equipment
- Interference to inspection-Temp/Rad/Insulation
- 3 nozzle leaks located near RPV head center

Management/Programatic Issues

- Industry Operating Experience
- Corrective Action Process
- Commitments
- Modification deferrals
- Technical Arrogance
- Lack of timely identification

Rate of Corrosion

- Corrosion rate compatible with EPRI's BA Corrosion Guidebook
- 4 yrs of significant corrosion rates
- Up to 8 inches of maximum progression
- 2 inches per year from nozzle 3 to 11
- Maximum rate of 4 inches per year-bounding rate assumptions
- Rate in lateral direction 1/2 of radial direction
- Significant Corrosion in 1998 and 1999
- Size, shape, crack size and BA accumulation provides basis for radial direction corrosion

Suggested Chain of Events

- 1987-1993 CRDM Nozzle Crack formed
- 1993-1993 Crack propagates through nozzle wall
- 1998-2000 Leak Not Identified/BA accumulation not removed
- 1999 Iron Oxide in CTMT atmosphere-Noteworthy corrosion
- 2002 Significant corrosion observed #3 nozzle, minor damage #2 nozzle

Return to Service Plan

- System Health Readiness Review
- Latent Issues Review
- Extent of Condition
- Changes in Behavior/Attitude
- Thinking out of the box
- Rigor and Vigilance